MEMORANDUM **CH2MHILL**

CIA Sludge Drying Beds

TO: Mary Kay Voytilla/EPA

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DATE: October 22, 1998

Introduction

Treatment of acid mine drainage (AMD) from the Bunker Hill Mine is currently achieved using lime neutralization in which the pH of the AMD is increased, thus precipitating dissolved metals as metal hydroxides. This process results in the production of chemical precipitation sludge requiring disposal. Currently, sludge is disposed of by pumping into the decant pond on top of the Central Impoundment Area (CIA). However, the CIA is scheduled for phased closure beginning in the 1999 construction season. Therefore, options for long-term sludge disposal need to be evaluated. Options for long-term sludge disposal include the following:

- Pump undewatered sludge into drying beds on the CIA, and annual excavation and disposal
- Pumping undewatered sludge into drying beds located elsewhere, and annual excavation and disposal
- Pumping undewatered sludge into the mine
- Mechanically dewatering the sludge and then disposal

Design of a lined sludge disposal pond within the limits of the CIA closure was previously completed, but was not constructed. The following discussion focuses on construction of a sludge dewatering bed (drying bed), on the existing CIA. Dewatered sludge would then be excavated annually and disposed.

Main Issues

The main issues to be evaluated to determine the feasibility of construction of dewatering beds are:

- Sludge beds size requirements
- Location of the sludge
- Construction

- Operations and maintenance
- Incorporation of the beds into the long-term closure plan for the CIA

Each of these issues is described below.

Size Requirements

Estimated annual maximum sludge volume (dry volume) is about 7,500 cy. This is based on high density sludge (HDS) production as demonstrated during CH2M HILL's 1997 HDS treatment plant trial conducted at the CTP, and on an assumption that the sludge will dewater from about 25 percent solids when it is placed to about 60 percent solids. 1997 is considered a very wet year, and produced more AMD than in recent years as reported by mine owner Bob Hopper. It was estimated in the HDS trial that about 5,400 cy of sludge would have been deposited in the CIA sludge beds if the HDS process was in use during all of 1997. To provide additional capacity for even larger AMD production years, it is recommended that a design capacity of 7,500 cy/yr be used.

Maximum preferred depth of the drying beds, for drying and excavation efficiency, is five feet. It is assumed that two equally sized drying beds, or a configuration of two separate cells, will be needed to allow for drying of the sludge prior to excavation. Disposal of sludge into the two separate cells would alternate annually, allowing a full twelve month drying period if necessary. At a five foot depth, the approximate size of the two beds is just over two acres including access roads as shown on the attached layout drawing.

Location

Location of the sludge drying beds should remain as close to the Central Treatment Plant as possible to reduce pumpage distance and minimize the length of piping. Based on discussions with the CIA closure design team, the preferred location of the sludge drying beds is just north of the existing sludge pond (see attached drawing). The area is flat, has fairly stable subgrade, and is readily integrated into the final cover. This area is also near the CIA access road which will facilitate sludge-haul truck movement. Construction in this area will require installation of a culvert in the large drainage swale north of the existing ponds for the access road crossing (see attached drawing showing the drainage swale).

Other potential areas examined, but ruled out, include the area just south of the drainage swale, and the site of the existing ponds. Although the sludge drying beds could be configured to fit in the area just to the south of the swale, construction in this area is not recommended, due to the large amount of concrete debris found in the subgrade. Construction in the area of the existing sludge and mine water ponds would result in less retrofitting of piping. However, construction of drying beds in this area is not recommended, due to potential differential settlement problems resulting from the unstable subgrade (approximately twenty five feet of sludge and unstable soils).

Construction

Proposed construction of the sludge drying beds is similar to the previously designed sludge decant pond. Since the beds will be constructed within the CIA Closure, construction should consist of a double-lined composite system, with a leak detection system. The recommended system, from top to bottom, is 60 mil high density polyethylene (HDPE), a layer of geosynthetic clay lining (GCL), a drainage layer composed of composite drainage

netting (CDN), and a final layer of HDPE. The CDN will serve as the leak detection layer. Each completed layer of HDPE should be tested for potential pinhole leaks, and hydrostatically tested.

Longevity of the system will be enhanced by protecting the liner with a (minimum) layer of 18" of drainage material. A paved access road will run the length of the pond, to allow for easier excavation and removal. Decant and filtrate water will be diverted back to the CTP. The sludge drying beds can be constructed as individual cells, or as one cell with a berm (access road) serving as a divider (see attached details).

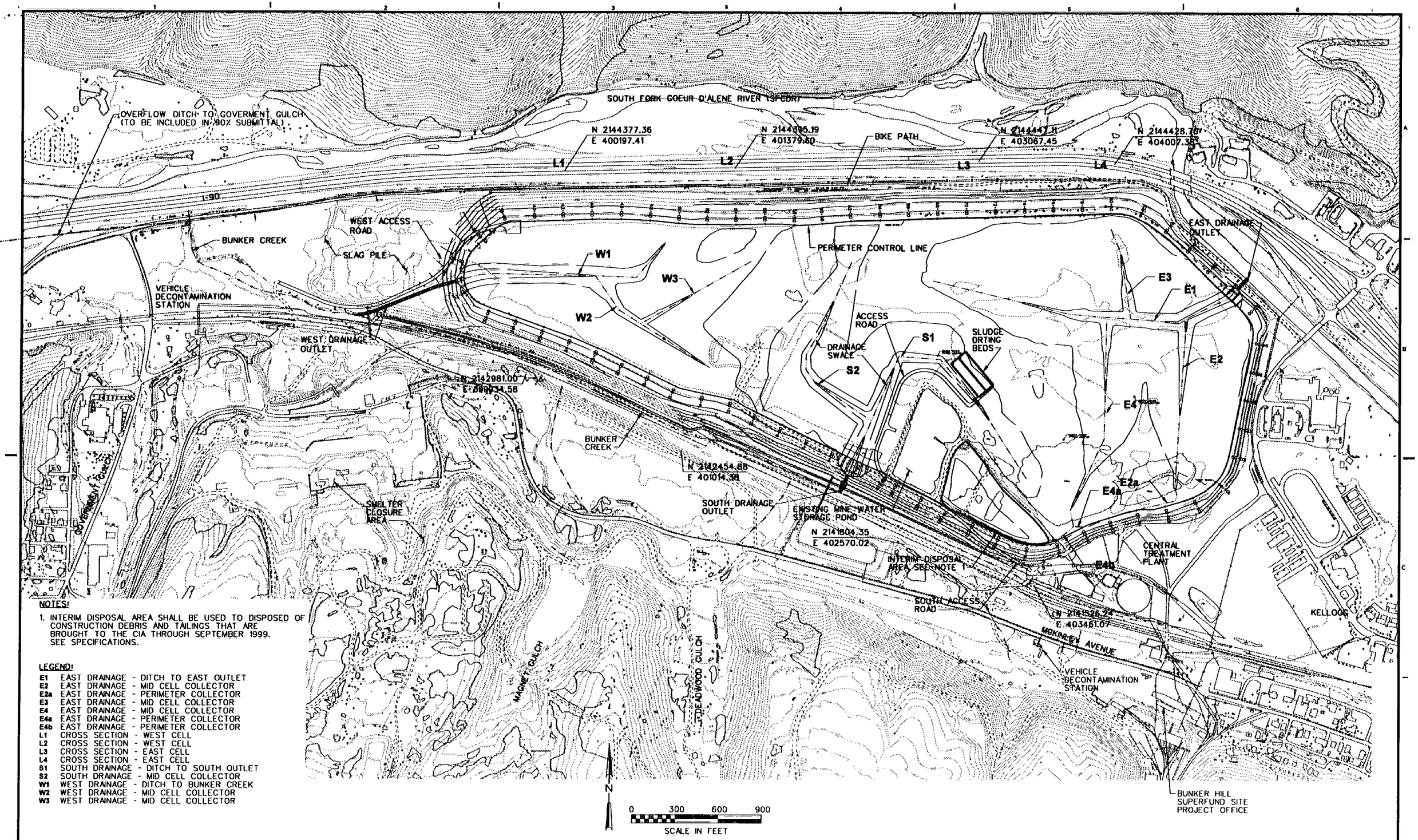
Operations and Maintenance

Sludge would be placed daily into the sludge bed by pumping thickened underflow from the CTP. Pumping durations would range from about one to four or more hours, depending on the amount of solids being generated due to the strength and flow rate of mine water. The freshly deposited wet sludge is anticipated to be about 25 percent solids by weight as it is pumped from the thickener, and it is anticipated that the sludge will dry to about 60 percent solids. Deposition into the sludge bed would be by a common sludge header pipe located in the access road between the beds. Multiple discharge locations would be provided, to ensure even distribution of the sludge. Initially, operation of the beds would be alternated annually.

It is anticipated that the sludge drying beds would be excavated in August and September. Total estimated truck volume of excavated sludge, with 10 yard haul trucks, is 1000 trucks, assuming a maximum annual generation of 7,500 cy and a 25 percent swell factor for the excavated sludge. The period available to haul would be at least 45 days, from late August through September. Other periodic maintenance would include sand replacement, inspection of the leak detection system to verify the integrity of the system, and piping inspection and maintenance.

Incorporation into Long-term Closure

Lined sludge drying beds may be constructed within the CIA closure area and operated indefinitely without adverse effects to the long-term closure, as long as proper operations and maintenance is carried out. Some regrading of the prepared subgrade may be necessary during construction to ensure proper pipe grades for gravity feed back to the CTP. To ensure effectiveness of the CIA cover, the lining of the sludge drying beds should be incorporated into the cover system, as shown on the attached figure.



NOTES:

1. INTERIM DISPOSAL AREA SHALL BE USED TO DISPOSED OF CONSTRUCTION DEBRIS AND TAILINGS THAT ARE BROUGHT TO THE CIA THROUGH SEPTEMBER 1999. SEE SPECIFICATIONS.

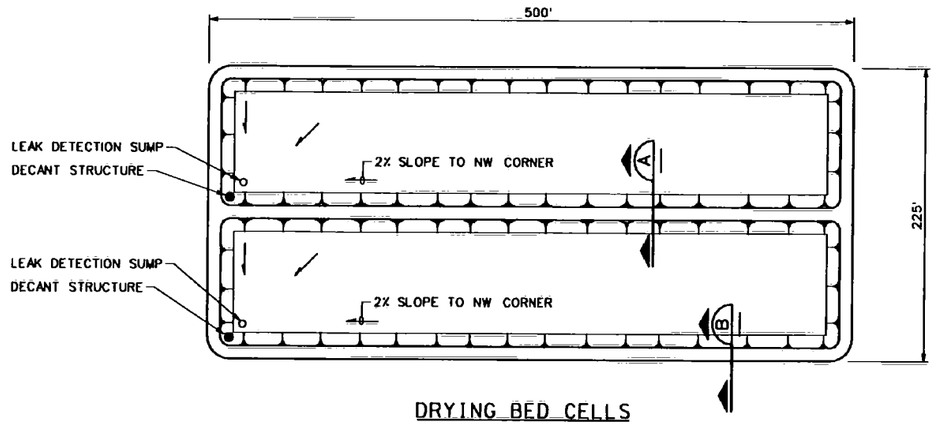
LEGEND:

E1	EAST DRAINAGE - DITCH TO EAST OUTLET
E2	EAST DRAINAGE - MID CELL COLLECTOR
E2a	EAST DRAINAGE - PERIMETER COLLECTOR
E3	EAST DRAINAGE - MID CELL COLLECTOR
E4	EAST DRAINAGE - MID CELL COLLECTOR
E4a	EAST DRAINAGE - PERIMETER COLLECTOR
E4b	EAST DRAINAGE - PERIMETER COLLECTOR
L1	CROSS SECTION - WEST CELL
L2	CROSS SECTION - WEST CELL
L3	CROSS SECTION - EAST CELL
L4	CROSS SECTION - EAST CELL
S1	SOUTH DRAINAGE - DITCH TO SOUTH OUTLET
S2	SOUTH DRAINAGE - MID CELL COLLECTOR
W1	WEST DRAINAGE - DITCH TO BUNKER CREEK
W2	WEST DRAINAGE - MID CELL COLLECTOR
W3	WEST DRAINAGE - MID CELL COLLECTOR

DSGN					VERIFY SCALE	CH2MHILL	BUNKER HILL SUPERFUND SITE U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 10
DR					BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.		
CHK							CENTRAL IMPOUNDMENT AREA CLOSURE
APVD	NO.	DATE	REVISION	BY	APVD		GENERAL SITE PLAN SLUDGE DRYING BEDS

SHEET
DWG NO.
DATE OCT 1998
PROJ NO. 148562.02.01

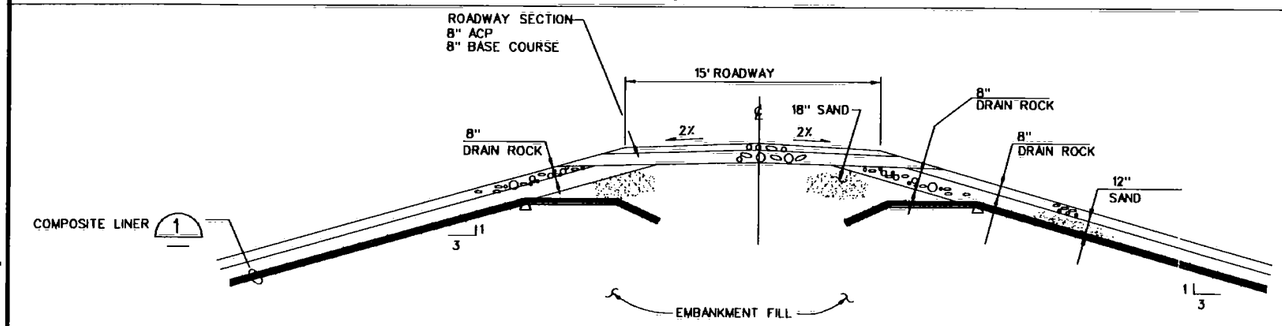
FILE NAME:



DRYING BED CELLS

PLAN

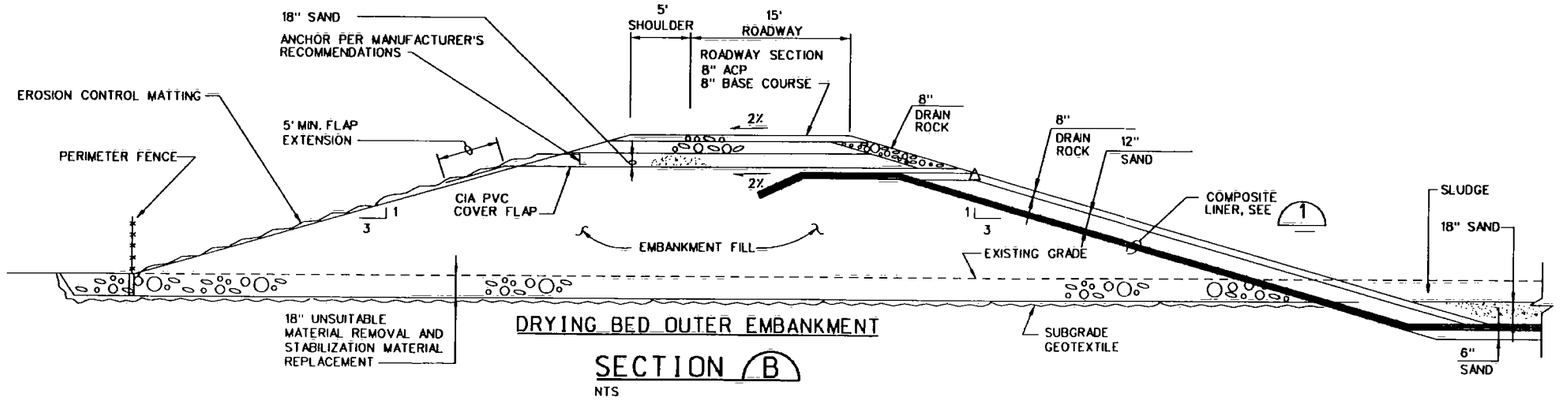
NTS



DRYING BED CELLS COMMON EMBANKMENT

SECTION A

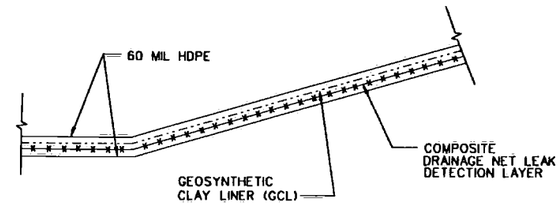
NTS



DRYING BED OUTER EMBANKMENT

SECTION B

NTS



COMPOSITE LINER SYSTEM

DETAIL 1

NTS

DSGN					VERIFY SCALE	CH2MHILL	BUNKER HILL SUPERFUND SITE U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 10	SHEET
DR					BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.			DWG NO.
CHK							SLUDGE DRYING BEDS LINER SECTIONS AND DETAILS	DATE OCT 1998
APVD	NO.	DATE	REVISION	BY	APVD			PROJ NO. 148562.02.01

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